alternating row of much smaller marginal ones. On the lower edge of the proximal portion of the club, extending from the middle backward, there is a row of four small, smooth-edged, unequal suckers, alternating with rounded, sessile tubercles that fit into corresponding suckers on the other arm; a row of similar but smaller suckers extends for about six inches along the inner surface in the median line of the arm, alternating at first singly, and then two by two, with tubercles, and gradually becoming more distant. The end of the arm, beyond the expanded club, bears minute serrate suckers, at first in six rows, decreasing to two toward the end. The extreme tip bears a small group of minute, smooth-edged suckers. The largest suckers of the club are decidedly constricted below the margin, and then swell out at the basal portion. The edge of the horny rim is divided into very numerous, small, incurved and crowded denticles, nearly equal in length, but part are thickened and obtuse, while the rest are more slender and acute. Diameter of the largest suckers, 6·5^{mm}; of the largest in the second row, 5·5; of the largest in the lateral rows, 3 to 4; of the largest smooth-rimmed marginal suckers, 2 to 2·5; of the smooth-rimmed suckers of the wrist, 1·5 to 2.

Sessile arms stout, trapezoidal, tapering to slender tips, and bearing two rows of numerous suckers. All the arms on the left side are an inch or more longer than the corresponding right ones. The dorsal and ventral arms, of the same side, are about equal, and decidedly shorter than the two lateral pairs, which differ but little in length. Web about two-thirds as broad as the length of the arms, uniting the upper three pairs together, and as a narrowing border extending along their sides, to the tips. The lower lateral arms have a thin, crest-like membrane on their outer, median surface, commencing at the basal fourth and extending nearly to the tips. The ventral arms are united together, toward the base, by a web, which is also joined to the main web, in the median plane. A narrow outer web, arising from the outer angles of the arms, also unites all the arms together for a short distance above their bases.

The suckers are all similar in form. The larger ones on the dorsal arms are, perhaps, a little larger than those on the lateral and ventral ones. The largest are subglobular, laterally attached, and gibbous; the aperture is small, usually with three or four flat, blunt, or rounded lobes or denticles on the outer margin, with none on the inner margin. The pedicels of the larger suckers are very stout at base, tapering up to their attachment on the lower side of the sucker, where they are small and slender. The largest suckers of the dorsal arms are 5^{mm}

in diameter; their apetures 2^{mm}; length of pedicels 4 to 5^{mm}. The largest suckers on the ventral arms are not so large as those on the others; the largest are 4^{mm} in diameter. Only a few suckers (5 or 6), and these of very small size and nearly in one row, extend below the level of the ventral web, which is attached along the inner margin, inside the row of suckers. The larger ventral suckers are depressed and oblique, with a very one-sided horny ring, which has a small oblique aperture, with about three bluntly rounded, slightly prominent lobes or denticles on the outer margin; while the inner margin is smooth.

The membranes about the mouth are arranged nearly as in *Ommastrephes*. The mouth is surrounded externally by a broad, elevated, smooth, dark chocolate-brown buccal membrane or collar, which is prolonged into six angular lobes, corresponding to all the intervals between the arms, except those between the 2d and 3d pairs; this buccal collar is connected to the interbrachial membrane by six membranous bridles, corresponding to the six lobes; on both sides of the dorsal and ventral bridles are large pouches. The beak is immediately surrounded by a thick, fleshy, lobed and wrinkled collar, and outside of this by another less prominent and less wrinkled one.

The exposed parts of the mandibles are black; the inner laminæ bright reddish brown. The beak of the upper mandible is very acute, strongly incurved, with scarcely any distinct notch at the base of the cutting edge, but with a conspicuously excavated V-shaped area; the anterior edges of the alæ are irregularly and slightly denticulate or crenulate. The lower mandible has a much incurved beak, with the cutting edges decidedly concave, and a very small notch at their bases, but with a broad excavated area along their sides and bases; the anterior edges of the alæ are slightly convex and form a very obtuse angle with the edges of the beak or rostrum; a small, thin tooth exists just beyond the notch; the alæ are broadest near their inner ends; the gular lamina is peculiar in having a prominent, thickened, curved, lateral rib, on each side, running to the end of the prolonged and subacute lateral lobes; and another dorsal one, running to the dorsal emargination. Length of upper mandible, 30^{mm}; height, palatine to frontal, 20; height (or breadth) of palatine 14; tip of beak to end of frontal, 22; to base of cutting edge (notch), 7·5; notch to inner end of alæ (union with palatine), 7·5; beak to posterior lateral border of alæ, 13·5; transverse breadth across outer side of alæ, 9·5. Lower mandible, length, 23^{mm}; inner ends of alæ to mentum, 22·5; tip of beak to dorsal border of gular lamina, 17; to inner ends of alæ, 18; to notch, 8·5; breadth of alæ in middle, 8; greatest

transverse breadth across alæ, 23; across anterior edge, at teeth, 7·5; notch to union of gular lamina and alæ, 6·5; breadth of gular lamina, 12·5.

The odontophore is rather short, the dorsal portion not much exceeding the ventral in length; the lateral membrane is broad and thin, its posterior border extending transversely straight across to the dorsal fold, nearly at right angles to the dorsal portion of the odontophore; the dentigerous portion, including a thickened lateral ridge, outside the teeth, is light red in color. Length of dorsal portion, from anterior bend, 8·5^{mm}; of ventral portion, 8; breadth of dentigerous zone, 3.

The median teeth are short, with a strongly incurved, acute central point, and with small inconspicuous or rudimentary, blunt lateral denticles on each side; the inner lateral teeth are considerably longer, without a distinct lateral denticle; the two outer rows have simple, rather slender, strongly incurved, acute teeth, the outermost a little longer and more slender. The plates along the border appear to be so closely united as not to be easily separated entire; they form a continuous, but slight, narrow ridge, which has an undulated surface. The membrane lining the palate bears pale yellowish, scattered, stout, not very acute, and but slightly curved teeth, with bases not much enlarged; among these are clusters of small, stony, smoothish granules, often aggregated into masses of considerable size. The gular membrane also bears aggregations of small, smoothish, rounded and angular granules, with others that are larger, oblong and oval, smooth, and more or less regularly arranged. The œsophagus is very long and slender, dark-colored.

Measurements of Histioteuthis Collinsii.

	Millimeters.	Inches.
Tentacular-arms, length	609 and 635	24 and 25
Diameter at base	12·5	·50
Breadth of club, without membrane	17·5	·70
Its membranous border	6·2	·25
Length of club	69	2·75
Length of the slender tip	31	1·25
Of dorsal crest	37	1·50
Length of dorsal arm of left side	355	14
Of 1st lateral (2d pair)	432	17
Of 2d lateral (3d pair)	438	17·25
Of ventral	361	14·25
Breadth of lateral arms, at base	22·5	·90
Thickness	19	·75
Diameter of eye-opening	22·5	·90
Diameter of head, at base of arms	87	3·50
Breadth of web, between arms	203 to 254	8 to 10
Diameter of largest suckers of tentacular-arms	6·5	·26

Taken from the stomach of *Alepidosaurus ferox*, lat. 42° 49′, long. 62° 57′, off Nova Scotia, by Capt. J. W. Collins and crew of the schooner "Marion," 1879.

All parts back of the eyes are absent, the eyes are mutilated, but the specimen is otherwise in excellent preservation, even the web and suckers being nearly uninjured.

Observations on some of the more important specimens described from other localities.

We are largely indebted to Professor Steenstrup and to Dr. Harting for our knowledge of the specimens preserved in European museums, or cast ashore on the European coasts. Professor Steenstrup* has given accounts, compiled from contemporary documents, of a specimen taken at Malmö, Sweden, about 1546 or 1549, and of two specimens of huge cephalopods cast ashore at Iceland, in 1639 and Nov. or Dec., 1790.

The specimen of 1790, described in the MSS. of Svend Paulsen, 1792, had tentacles 3 fathoms long; the body (with head) was 3½ fathoms long. That of 1639, described in Olafsens og Povelsens Reise til Island, ii, 716, was 4 to 5 fathoms long.

In the article published in 1857, he also briefly mentioned a specimen cast ashore at Jutland, Dec., 1853, of which the jaws were preserved, and on which he then based the species *Architeuthis monachus;* and another specimen, which he named *Architeuthis dux*, taken by Capt. Vilh. Hygom, in the western Atlantic. He has also since described and figured† the jaws of the specimen of *Architeuthis monachus*, obtained at Jutland, in Dec., 1853.

In the same memoir, of which I have seen only the first part, there are references to a description and figures of '*A. Titan*,' obtained in 1855, by Capt. Hygom, in N. lat. 31°, W. long. 76°. The latter specimen appears to be the same as that referred to in 1856, as *A.*

* Meddelelse om tvende Kiæmpestore Blæksprutter, opdrevne 1639 og 1790 ved Islands Kyst, og om nogle andre nordiske Dyr. Förhandlinger Skandinaviske Naturforskeres, v, pp. 950–957, 1847, Copenhagen, 1849.

Oplysninger om Atlanter colossale Blæksprutter Förhandlinger, Skand. Naturf., 1856, vii, p. 182, Christiania, 1857. Cephalopodum, qui in Museis Hafn. inveniuntur, Kjobenhavn Oversigt., 1861, pp. 69, 165.

† In a paper of which I have seen some proof-sheets, given by him to Dr. Packard, entitled "Spolia Atlantica." This memoir has not been published. The plate (1) that I have seen is marked "Vid. Selsk. Skrifter, V. Række, naturv. og mathem. Afd. iv Bind;" and there are references to three other plates, illustrating '*A. Titan*,' etc.

dux, and the same that Harting* mentioned, under the name '*Architeuthis dux* Steenstrup,' as collected at the same time and place, and of which he published an outline figure (see Plate XXV, fig. 2) of the lower jaw, copied from a drawing furnished to him by Steenstrup.

Harting states that the pen or 'gladius' of this specimen is six feet long. Many important parts of this specimen were secured, and I regret that I have been unable to see the figures and description of it, referred to by Harting as forming part of Professor Steenstrup's unpublished memoir. But to judge by the outline figure given by Harting, it is a species quite distinct from those described by me. The lower jaw resembles that of *A. Harveyi* more than *A. princeps*, and is a little larger than that of our No. 5. The beak is more rounded dorsally, less acute, and scarcely incurved; the notch is narrow, and the alar tooth is not prominent.

M. Paul Gervais, in the Journal de Zoologie, iv, p. 90, 1875, gives a short description of this species, based apparently on the proof-sheets and unpublished plates, not seen by me, of Steenstrup's article, referred to above. He describes it as follows: A large species, of which a fragment of an arm preserved in the Museum of Copenhagen is nearly as large as the arm of a man. The sucker-bearing surface of the arm is extended bilaterally into a membrane exceeding, on each side, the arm itself. Diameter of the opening of the suckers, 0·020; of the suckers themselves, 0·030. Length of the dorsal bone (pen), 2^m; breadth [longueur, by error], measured in the middle of its length [longueur], 0·17. He refers to Steenstrup's Plates, III and IV.

In a letter to the writer, dated Sept. 4, 1875, Professor Steenstrup states that in addition to the specimens above mentioned, there are, in the Museum of the University of Copenhagen, two complete specimens of *Architeuthis*, preserved in alcohol. Both are of comparatively small size. One, from the northern coast of Iceland,† he refers to *A. monachus*. It has tentacular-arms 10 feet long, and sessile arms 4 feet long. The other is a still smaller one, from the warmer parts of the Atlantic, possibly the young of *A. dux*.

It is evident, therefore, that at no distant day, most of the remaining doubtful points in respect to the structure and relationship of the

* Description de quelques fragments de deux Céphalopodes gigantesques. Publiées par l'Académie Royale des Sciences à Amsterdam. 1860. 4to, with three plates (Verh. K. Akad. Weten., ix, 1861.) The figures have been partly copied in Tryon's Manual of Conchology, i, plates 60 and 86.

† This one is referred to by Dr. Packard, Amer. Naturalist, vol. vii, p. 94, 1873.

species of this genus, can be cleared up by Professor Steenstrup, even if additional specimens should not be obtained.

The publication of Professor Steenstrup's detailed memoir upon this genus would give great pleasure and satisfaction to all students of this class of animals. His thorough knowledge of the group, and his numerous and important investigations of the Cephalopods, published during many years, will give especial value to his conclusions.

Harting, in the important memoir referred to, describes specimens of two species, both of which are apparently distinct from all the Newfoundland specimens enumerated by me.

The first of these (his Plate I) is represented by the jaws and buccal mass, with the lingual dentition, and some detached suckers, preserved in the museum of the University of Utrecht, but from an unknown locality. These parts are well figured and described, and were referred to *Architeuthis dux* by Harting. The form of the lower jaw (see Pl. XXV, fig. 1) is unlike that of *A. dux*, for the beak is very acute, the cutting edge is concave, the notch shallow and broad, and the alar tooth is somewhat prominent. The size is about the same as our No. 5. The suckers (Pl. XXV, fig. 1*a*, 1*b*) are from the sessile arms, and agree pretty nearly with those of *A. Harveyi*. The edge is strengthened by an oblique, strongly denticulated ring, which, in all the suckers figured, including both larger and smaller ones from the short arms, has regular, acute, sub-equal denticles all around the circumference, in this respect agreeing with *A. Harveyi*. The internal diameter of the largest of these suckers is ·75 of an inch; the external, 1·05 inches. They were furnished with slender pedicels, attached obliquely on one side. The lingual teeth (see Plate XVI, fig. 8, copied from Harting) are in seven regular rows, and resemble closely those of *Loligo*. On that account mainly, in a former paper, I proposed to designate it by the name of *Loligo Hartingii*. But since that time I have been able to study the dentition of species of *Architeuthis* and *Sthenoteuthis*, and now refer Harting's species to *Architeuthis* without hesitation, although the dentition is poorly figured. Professor Steenstrup, in a letter to me, subsequent to the publication of my former papers, also expressed the opinion that Harting's specimen belongs to *A. monachus*. If distinct, however, as is possible, it may be called *Architeuthis Hartingii*.

The other species described by Harting was from the Indian Ocean, and belongs to the genus *Enoploteuthis*.

In this genus there are large, sharp, curved claws (Pl. XXV, figs. 4, 4*a*), both on the club of the tentacular-arms and on the sessile arms,

in place of the suckers of ordinary squids. The teeth of the odontophore, in Harting's species, are remarkably small and simple (see fig. 4, *b*), after Harting. As this species does not appear to have had a special name, I propose to call it *Enoploteuthis Hartingii.*

D'Orbigny* gave the name *Enoploteuthis Molinæ* to a large species, of which the body was estimated to be about 4 feet long, found floating and mutilated in the South Pacific, S. lat., 30° 44′; W. long. 110° 33′, by Banks and Solander, in 1769, on Capt. Cook's second voyage. Of this, fragments are preserved in the Museum of the College of Surgeons, London.†

A similar species, perhaps identical, had previously been recorded by Molina, from the coast of Chili, as *Sepia unguiculata.*

According to Jeffrey's British Conchology, vol. v, p. 124, a huge Cephalopod was stranded in 1860 or 1861, between Hillswick and Scalloway, on the west of Shetland. "From a communication received by Professor Allman it appears that the tentacles were 16 feet long, the pedal-arms about half that length, and the mantle sac, 7 feet; the mantle was terminated by fins; one of the suckers examined by Professor Allman was $\frac{3}{4}$ inch in diameter."

Mr. Kent, in the articles already referred to,‡ mentions a sessile arm of a giant cephalopod, which has been long preserved in the British Museum, but of which the origin is unknown. He states, in the first article, that it is just 9 feet long and 11 inches in circumference at the base, tapering off to a fine point. There are about 150 suckers, in each of the two alternating rows, those at the base being ·75 of an inch in diameter.

In his second article he refers this arm doubtfully to *Ommastrephes todarus*, and gives the following description:

"The length of this arm, from one extremity to the other, is just 9 feet; the circumference at the base 11 inches; and from this it gradually decreases, terminating in a fine point. The suckers are arranged in two rows throughout the extent of the arm, numbering, approximately, 150 to each row, or a total of 300 to the whole organ. Forty-three suckers only are stationed on each side in the first or proximal half of the arm; one hundred on each side occupy the whole length, with the exception of 14 inches, this smaller length including the remaining fifty on each side, which are very minute and crowded

* Histoire Nat. des Céphalopodes Acétabuliferes, p. 339, 1845.

† See also Todd's Cyclopedia of Anatomy and Physiology, i, p. 529.

‡ Proceedings Zoological Society of London for 1874, pp. 178 and 493.

together. The comparative distances between the suckers throughout the whole length in each row are as follows:—between the first and second sucker, 1½ inch; halfway up the arm, 1 inch; at three quarters of the entire length, ½ inch; and within six inches of the distal extremity, ¼ inch. The relative diameters of the suckers at similar distances are:—at the base, extreme outside measurement ¾ inch, inside measurement of corneous ring ½ inch; and, those suckers a little past the first few being the largest, halfway down ½ inch outside and ½ inch inside measurement, at three quarters length ¼ inch, and at 6 inches from the extreme point ⅛ inch outside measurement, gradually diminishing from here to the size of a pin's head.

The shape and structure of the suckers upon this British-Museum specimen agree with those of *Ommastrephes todarus* as given by D'Orbigny, corresponding also with those figured by Harting, referred by him to the same species, and anticipated by the same authority to be also identical with Prof. Steenstrup's *Architeuthis dux*. More minutely they may be described as hemispherical in shape, the stalk or peduncle being attached laterally at the base of the hemisphere, the point of insertion of the same in the cup being marked by a conspicuous pit-like depression. The horny ring is obliquely set, and much deeper at the side opposite the insertion of the stalk; the inner margin is serrated; and in most examples the serratures bordering the deeper side are considerably larger than in the other portions of the circumference; in some instances the serratures, except at the particular point mentioned, are altogether aborted, having the inner margin of the ring quite smooth; in other examples, and more especially among the larger suckers, the teeth or serratures are equal or subequal. The average number of the teeth of the largest rings is twenty."

Mr. Kent, unfortunately, does not state to which pair this arm belongs. But from his description, it is, perhaps, a ventral arm. It evidently belongs to an *Architeuthis*, and is very near to our *A. princeps*.

Lieut. Bouyer, of the French steamer 'Alécton,' encountered a huge cephalopod, in November, 1860, between Madeira and Teneriffe. Its body was estimated to be between 15 and 18 feet in length. A long and laborious attempt was made to capture it, and a slipnoose was passed around the body, but on attempting to hoist it on board the rope cut through the soft flesh and the tail alone was secured. A sketch of the animal was made by one of the officers, and Messrs. Crosse and Fischer* have, from this figure and the narrative of the

* Journal de Conchyliologie, 3d ser., vol. ii, p. 138, 1862. See also Tryon's Manual of Conchology, vol. i, p. 87, Plate 59, 1879 (figure copied from the original).

officers,* proposed to establish a species for this specimen, which they named *Loligo Bouyeri.* The figure is very imperfect, but evidently represents a ten-armed cuttle-fish, though only eight arms are shown, and the tail is represented as truncated. In fact, there is nothing about the figure or description sufficient to indicate specific, or exact *generic* characters. The eight short arms, shown in the figure, are stout, tapered, and less than half the length of the head and body together. It was more probably a species of *Architeuthis*, to judge from the caudal fin, described as consisting of two rounded lobes, of small size. It may be designated as *A. Bouyeri*, provisionally.

In the Journal de Zoologie, vol. iv, No. 2, p. 88, 1875, M. Paul Gervais has given a partial summary of the gigantic Cephalopods previously known, and has mentioned an additional species (*Architeuthis Mouchezi* Vélain), of which portions were brought to Paris by M. Vélain, from the Island of St. Paul, Indian Ocean, where it was cast ashore in November. He also quotes the brief notice of the animal by M. Vélain (in Comptes Rendus, t. lxxx, p. 1002, Seance du April 19, 1875). It is stated that this example belongs to the same group with *Ommastrephes.* A description and a rude figure of it, made from a photograph taken in the position in which it lay upon the shore, has also been published by M. Vélain in the Arch. de Zool. Exper., vol. vi, p. 83, 1877. The figure has been copied in Tryon's Manual of Conchology, vol. i, Pl. 82. According to this figure the tentacular-arms were very long and the short arms were truncated, probably owing to mutilation. One of the tentacular-arms was saved, and, with the beak, is preserved in Paris. The caudal fin was narrow and lanceolate, adhering to the sides of the body by its entire length. In the latter feature this is very different from any of the northern species.†

In the Archives de Zool. Experimentale, vol. vi, 1877, M. Vélain has proposed a new genus (*Mouchezia*) for this specimen. The peculiarity of the pen appears to be the only character, of any importance, referred to by him.

In The Zoologist, London, 2d Series, No. 118, p. 4526, July, 1875, there is an article entitled, "Notice of a gigantic Cephalopod (*Dinoteuthis proboscideus*), which was stranded at Dingle, in Kerry, two hundred years ago. By A. G. More, F.L.S." The article is chiefly a reprint of the rude, but interesting, popular accounts written at the time of the capture, and upon these Mr. More attempted to found a new genus and species. The character which he mainly relied upon,

* See Comptes Rendus, Acad. Sci., vol. 53, pp. 1263–7, 1861.

† See also Tryon's Manual of Conchology, i, pp. 89 and 184, 1879.

as of generic value, is the power of projecting the beak in the form of a proboscis. But this is habitually done by the various common species of *Ommastrephes*, *Loligo*, etc., and perhaps by all ten-armed cephalopods. There is not sufficient evidence, from the published accounts, that this specimen differed in any way from the *Architeuthis monachus*. It was described as 19 feet in total length; the long arms having been mutilated, the part remaining was 11 feet long, and as thick as a man's arm; the short arms varied from 6 to 8 feet in length, and were as thick as a man's leg, and had two rows of large serrated suckers; the proboscis (buccal mass with beak) was the size of a man's fist; the beak was "somewhat like to an Eagle's Bill, but broader." The whole animal was said to have been as large as a large horse. The length of the head and body together was 8 feet.

Mr. More has kindly sent me a tracing from the original figure. This shows a broad, oval, flat body, and a small caudal fin. The body or mantle had evidently been split open and spread out flat.

This fact is also evident from the original descriptions reprinted by Mr. More, in which the sides of the mantle are described as follows: "Over this Monster's back was a mantle of a bright Red Color, with a fringe round it, it hung down on both sides like a Carpet on a table, falling back on each side, and faced with white." The liver, according to the descriptions, had been removed: "When it was dead and opened the liver wayed 30 pound." The proboscis had also been removed before it was exhibited, and it is therefore very probable that the figure and descriptions represent it as more extended than was natural.

The measurements given indicate a specimen smaller than several of the American examples, and but little, if any, larger than our No. 5, from Logie Bay.

In the Zoologist, June, 1875, p. 4502, and August, p. 4569, and in the August number of the Annals and Magazine of Natural History, vol. xvi, p. 123, the same writer gave an account of the capture, and briefly described the beak, odontophore, and portions of the tentacles and arms of another specimen, taken off Boffin Island, on the west coast of Ireland, April, 1875. The tentacular-arms are said to have been 30 feet long; the expanded portion 2 feet 9 inches; the large central suckers nearly 1 inch in diameter; those of the outer rows ·5 of an inch; one short arm is said to have been 8 feet long, and 15 inches in circumference at the base, when fresh. It had small suckers without teeth on the horny rings, on the 'wrist' of the 'club' and

scattered along the tentacular-arms, as do our specimens. The rounded tubercles that always accompany these smooth-rimmed suckers are not mentioned, but doubtless they were also present. The beak was 5·25 inches long and 3·5 broad, dark reddish brown, "with a large tooth in both margins of the inner mandible and a much smaller notch on each side of the outer mandible."

Mr. More believed this to be distinct from the Newfoundland species and referred it to *A. dux*, but his description agrees closely with the corresponding parts of *A. Harveyi* (No. 5) described by me, except in the relatively somewhat greater size of the sessile arms at base. In this respect, however, it is equalled or surpassed by our No. 14, and by others of the Newfoundland examples. This may also be only a peculiarity of the female. The measurements indicate a specimen intermediate in size between our Nos. 5 and 14, but the description is not sufficient to indicate with certainty to which of our species it was nearest related. A more detailed description, with figures of the suckers and odontophore, would probably settle this point. Mr. More supposed that the lateral suckers of the tentacular-club were larger in his example than in *A. Harveyi*, but that is not the case.

A large cephalopod, referred doubtfully to *Ommastrephes*, has been recorded from Japan and described by Dr. F. Hilgendorf.* It was taken on the east coast of Japan, N. lat. 35° to 36.° It had been split open, salted, and partly dried, and the viscera had been removed. The ends or clubs of the tentacles were also gone. In this condition it was on exhibition in Yedo. The following are the measurements given: Tip of tail to front edge of mantle, 186^{cm} (6 feet, 1 inch); mantle to mouth, about 41^{cm} (1 foot, 5 inches); longer sessile arms, 197^{cm} (6·5 feet); from tip of tail to tip of sessile arms, 414^{cm}; total expanse across outstretched tentacles, 600^{cm}; circumference of mantle (breadth as cut open), 130^{cm}; length of caudal fin, 60^{cm}; breadth of caudal fin in middle, 45^{cm}; breadth of forward end of caudal fin, 28^{cm}; diameter of posterior tip, 1^{cm}; tongue of funnel, 10^{cm} broad, 6^{cm} long; eye-opening, which was oblong-oval, without an obvious sinus, 19^{cm}; distance between eyes, 26^{cm}; diameter of oval skin of lip, 12^{cm} by 8^{cm}; breadth of sessile arms, 11^{cm}; of tentacles, 2 to 3^{cm}; diameter of horny rings of suckers, on base, 1·5^{cm}; height, 0·7^{mm}; number of denticles, 37.

* Mittheilungen der deutschen Gesellschaft für Natur und Välkerkunde Ostasiens. Herausgegeben von dem Vorstande, 1st Heft, p. 21, May, 1873, Yokohama, Japan. See also American Journal of Science, vi, p. 237, Sept., 1873.

The following species, although the specimens, when found, had lost some of their most characteristic parts, appears to be nearly related to *Onychoteuthis*, a genus having sharp claws instead of suckers on the 'club' of the tentacular-arms, and a cluster of small tubercles and smooth suckers on its 'wrist,' to unite the arms together. It probably belongs to the group *Lestoteuthis*, characterized below.

Onychoteuthis robusta (Dall).

Ommastrephes robustus (Dall, MSS.) Verrill, American Journal Science, vol. xii, p. 236, 1876.

PLATES XXIII and XXIV.

This large and very interesting species* was discovered by Mr. W. H. Dall, near Iliuliuk, Unalashka I., off the coast of Alaska.† He found three specimens thrown upon the beach, April 26 and May 8, 1872. He made descriptions, measurements, and some very valuable drawings of them, while fresh. The specimens had all been more or less mutilated by the ravens before they were discovered. He preserved the pharynx, beak, and odontophore of No. 1; part of the 'bone,' a piece of the caudal fin, and the basal part of one of the ventral arms, with five of the suckers adhering, from one of the other specimens, (No. 2), and has generously placed them in my hands for examination, together with his drawings, measurements and notes.

The parts remaining of the largest specimen, No. 3, when found had a total length of 427^{cm} (14 feet), but the ends of the tentacular-arms had been destroyed; length from tail to base of tentacular-arms, 559^{cm} (8 feet, 6 inches); to front edge of mantle, 232·4^{cm} (7 feet, 7½ inches); width across fins, 107^{cm} (42 inches); diameter of body, 45·7^{cm} (18 inches); slender basal portion remaining of tentacular-arms, 155^{cm} (61 inches); their diameter, 6·3^{cm} (2·5 inches); short arms (ends gone), 76 to 102^{cm} (30 to 40 inches); length of pen, 226^{cm} (7 feet, 5 inches).

According to Mr. Dall's notes the color was reddish, in fine red dots on a whitish ground, with a darker stripe on the outer median line of the arms. The eyes were bluish-black, furnished with lids, and with a small sinus in front; diameter of the opening, 2·5^{cm} (1 inch).

The mandibles retracted into a short, yellow, puckered muzzle, which was included in a longer, plain, proboscis-like tube, extending an inch or two beyond. Siphon, short and thick.‡ Region of the eye

* This is the species referred to as perhaps *Onychoteuthis Bergi* by Mr. Dall in his note upon large cephalopods, in the American Naturalist, vol. vii, p. 484, 1873.

† The first specimen was found by Mr. M. W. Harrington, of Mr. Dall's party, on the west shore of Amaknak Island. Captain's Harbor, Unalashka, April 26th.

‡ No valve is shown in Mr. Dall's sketches.

somewhat raised. The nuchal collar is well-marked, and slightly above it, on each side, is a raised epidermal ridge, from which three wavy, raised bands or frills, attached at their inner edge, pass obliquely backward, on each side. No cranial cartilage was observed. Mantle firm and dense. The neck has one median dorsal and two ventral facets, long, oval-shaped, with a median depressed line, but otherwise smooth and white; the dorsal moves on a smooth part of the inside of the mantle; the ventrals move on similar raised facets of the mantle beneath. The caudal fin was rather broad, lanceolate or spear-shaped, acute at tip. Gills yellowish olive, with obliquely transverse laminæ. Gizzard, yellowish, the muscles laid like a coil of spun-yarn, in layers transverse to one another.

The pen, (Pl. XXIII, figs. 4, 5,) was gone from the first specimen (No. 1) and broken in the others. It was found unattached, in the dorsal cavity. It had a thickened median rib, but becomes very thin at the sides, and is divided by sharp, stiff ribs or folds into three longitudinal areas, on each side (Pl. XXIII, fig. 6). The posterior end is one-sided, funnel-shaped close to the tip, which is inserted into a long, round, thick, firm, cartilaginous cone, which tapers to a point posteriorly. The portion of the pen (of No. 2) preserved* and forwarded to me, includes all the cone and a part of the posterior end of the quill-portion, attached within the concavity of the cone (Pl. XXIV, fig. 7). The anterior end of the cone is concave and very obliquely terminated, the dorsal side extending forward some distance along the dorsal side of the quill. The whole length of the preserved cone, (doubtless much shrunken by the alcohol) is 44·5^{cm} (17·5 inches); of the oblique anterior termination, 15·25^{cm} (6 inches); greatest diameter, 4^{cm} (1·6 inches). The cone is nearly round, firm, translucent, brownish, or deep amber-color, and composed of numerous distinct concentric layers. The concavity of the anterior end firmly embraces the remnant of the funnel of the quill, which has numerous small costæ converging to the apex; two of the dorsal costæ are much stronger than the rest, forming a strong ridge each side of the smaller median costa, which lies in a deep median depression or furrow.

The tentacular-arms had lost their clubs; but the part remaining was cylindrical, 2·5 inches in diameter. The other arms were some-

* Mr. Dall states that he attempted to dry the rest of this pen, and that of No. 3, but they turned brown, and then black, effloresced, and decomposed. He also states that the pen, when fresh, was translucent whitish, and that it changed to brownish yellow in the alcohol.

what thicker. The few suckers remaining on them, were attached by slender pedicels, and arranged in two alternating rows; they were furnished with horny rims having the edge entire, except where irregularly broken away; those of the distal part of the arms were gone.

The portion of the arm of the second specimen, preserved in alcohol and sent to me, came from the base of the left ventral arm. It is 65^{mm} in length; diameter, from inner to outer surface, not including marginal membrane, 45^{mm}; including membrane, 64^{mm}. It is well rounded on the inner face, but more flattened on the upper side, while the outer surface is broadly rounded; the outer angle has a strong, thick, marginal membrane, 19^{mm} wide (see section of this arm, Plate XXIV, fig. 8, *c*). The sucker-bearing surface is broad, with a slight marginal membrane along each margin (*b*, b^1) rising into broad, flat, somewhat thickened blunt lobes alternating with the suckers. Two alternating rows of firm, smooth, rather irregular-shaped tubercles, run along the median region, between the rows of suckers, with which they alternate, on each side.

This segment of the arm still bears five suckers, which appear to represent the 1st, 2d, and 4th pairs, though there may possibly have been others before the first of these. They are all similar, rather small in proportion to the arm, round, but little oblique, decidedly convex beneath, and with a rather long, slender pedicel, (fig. 8, *a*). The horny marginal rings are dark brown, yellowish at the thin edge, which is entire and nearly smooth, except where broken. The largest of these remaining suckers are $8{\cdot}5^{mm}$ in diameter, outside; aperture, 5^{mm}; height of cup, 7^{mm}; length of pedicel, 3^{mm}.

The exposed parts of the jaws are black and polished; their internal laminæ are reddish brown, becoming translucent yellowish toward the margins.

The upper mandible (Plate XXIV, fig. 5), has an elongated, tapered, considerably incurved and sharp rostrum; the notch is rather narrow and deep, and a well-developed, triangular, lateral groove runs down from the notch for some distance, its upper border being in line with the cutting edge of the rostrum. The anterior edge of the alæ, so far as normally exposed, is nearly straight, but slightly undulated.

The lower mandible (Plate XXIV, fig. 6), has the cutting edges of the rostrum slightly concave, with a slight notch close to the tip, which is small and incurved; the notch at the base is broad and shallow, bordered externally by a slight, angulated ridge; the exposed anterior edges of the alæ have, each, two slight lobes, but are otherwise nearly straight; the alæ are broader toward the inner end, which is obtusely rounded.

The lower mandible now measures, from the tip of the rostrum to the posterior dorsal border of the mentum, 13mm; tip to the extreme posterior end of the gular lamina, 50mm; to the dorsal angle of the same, 33mm; tip to the inner end of the alæ, 46mm; to the bottom of the notch, 13mm; breadth of alæ, 24mm; transverse breadth at notches, 12mm.

The upper mandible, from the tip of the beak to the end of the palatine lamina, is 71mm long; from tip of beak to end of frontal lamina, 53mm; to bottom of notch, 11mm; length of exposed (dark) portion of anterior edge of alæ, 14mm.

The odontophore (Plate XXIV, figs. 1–4), has a very broad, thin, marginal membrane, yellowish-white in color, becoming brown and thickened toward the dentigerous portion, where there is a row of very small, thin plates, bordering the outer row of teeth; the ventral portion of the dentigerous band is dark brown, regularly convex, and narrowed gradually to the obtuse end; the dorsal portion is considerably longer, abruptly bent backward, with the borders incurved, gradually decreasing to the posterior end; on this part the teeth become much smaller and paler.

The outer lateral teeth, on the anterior portion, are long, slender, sharp, and strongly curved; the median ones are much shorter, with a sharp, strongly curved central point and a very small, almost rudimentary denticle on each side; the inner laterals are a little longer than the median, with a stout incurved point; on the outer side of its base there is a small denticle; the teeth of the two outer rows, on each side, are simple.

Length of odontophore, from anterior bend to posterior tip of dorsal end, 22mm; to tip of ventral end, 14mm; breadth of lateral membrane, in middle, 11mm; of dentigerous belt, anteriorly, 3mm.

The following measurements were made by Mr. Dall, from the fresh specimens.

Table of measurements (in inches).

	No. 1.	No. 2.	No. 3.
Total length (to mutilated ends of tentacles),	80+	110+	167+
Base of arms to tip of tail (head and body),	51	67	102
Base of arms to edge of mantle (head),	5	6	10·5
Edge of mantle to tip of tail (body),	46	61	91·5
Length of tail-fins (insertion to tip),	--	33·75	48
Breadth of tail-fins,	13·5+	25·5	42
Length of 'pen,'	--	60	89
Breadth of pen, in middle,	--	--	12·25
Length of tentacular-arms (ends gone),	30+	43+	61+
Length of longest sessile arms (ends gone),	30+	23·5+	40+
Diameter of body,	7·5	--	18
Breadth between insertions of fins,	--	3·5	5
Diameter of eye,	--	1	1·25

The generic affinities of this species must be regarded as still somewhat doubtful, owing to the absence of the tentacular-clubs, and most of the suckers of the sessile arms. The characters of the 'pen;' of the dentition, especially of the median teeth; of the nuchal frills; of the siphon; and of the cartilaginous facets of the neck, all indicate that it belongs in the family *Onychoteuthidæ*, near *Onychoteuthis*. But in this family there is great diversity as to the arrangement of the hooks and suckers, constituting the armature of the arms. Some of these combinations are as follows:

Sessile arms with suckers only.

Onychia.—Tentacular-club with two central rows of hooks, rows of small suckers along each margin, and a cluster of suckers and tubercles on the 'wrist.' Sessile arms with smooth suckers.

Onychoteuthis (typical).—Tentacular-club with two rows of hooks, with an apical cluster of suckers, and with a cluster of suckers and tubercles on the wrist. Sessile arms with suckers in two rows.

Ancistroteuthis (typical).—Two central rows of hooks, with proximal and apical suckers on the club, as in the last. Pen with a long, terminal, cartilaginous cone.

Ancistroteuthis Krohnii.—Tentacular-club with one row of suckers and one of hooks in the middle portion.

Dosidicus.—Tentacular-club with hooks. Sessile arms with large suckers on the proximal portion and small ones on the distal. Pen with a solid cone.

Sessile arms with both suckers and hooks.

Gonatus.—Tentacular-club with one or two central hooks proximally, and with numerous, multiserial, small suckers, distally. Sessile arms with four rows of suckers, those of the two central rows with a median hook, the outer ones serrate.

Abralia.—Tentacular-club with two rows of alternating hooks and suckers, in the middle, and with clusters of suckers on the wrist and apex. Sessile arms with hooks on the basal portion, and suckers toward the tips.

Lestoteuthis (gen. nov.).—Tentacular-club with numerous suckers, and few large central hooks. Sessile arms dissimilar; lower ones with four rows of suckers; upper with two central rows of hooks, and with marginal suckers on each side. Pen with a long terminal cone. (Type *A. Kamschatica* Middendorff, sp.)

Sessile arms with hooks only.

Verania.—Tentacular-club with suckers only; sessile arms with hooks only.

Acanthoteuthis.—Tentacular and sessile arms with hooks (fossil).

Ancistrocheirus.—Tentacular and sessile arms with hooks in two rows. Pen dilated at both ends.

Enoploteuthis (typical).—Tentacular-club with two rows of hooks, and with a cluster of small suckers on the wrist. Sessile arms all with hooks in two rows, extending to the tips.

It will be evident from these characters, that Mr. Dall's species, having two rows of smooth suckers, at least on the basal portion of the ventral arms, can belong to none of these genera, except those in the first group and *Lestoteuthis* in the second. Of these, *Gonatus* would be excluded from consideration by its different pen and four rows of suckers; *Onychia* and typical *Onychoteuthis* by the form of the pen. After this elimination we still find three generic groups to either of which it might belong, so far as its armature is known, viz: *Ancistroteuthis*, *Dosidicus*, and *Lestoteuthis*. The first of these is, perhaps, nothing more than a sub-genus of *Onychoteuthis*, the principal difference being in the pen, which is somewhat pennate and lanceolate in the typical species of the latter, but nearly linear with a solid cartilaginous terminal cone in the former. In this last character, and in the general form of the pen, *O. robusta* somewhat approaches *A. Lichtensteinii*. But *Dosidicus* and *Lestoteuthis* also have a solid cartilaginous cone, and the latter, especially, agrees most closely in the general form of the body and caudal fin; and its pen has very nearly the form and structure seen in *O. robusta*.

So far as we can judge, therefore, with our present imperfect data, the relationship of *O. robusta* appears to be rather with *Lestoteuthis* than with any other known group. It is possible, however, that its affinities may prove to be closer to *Ancistroteuthis*, when the armature is discovered.

Lestoteuthis, gen. nov.

The characters of *Lestoteuthis Kamschatica*, which I propose to take as the type of this generic group, are not yet fully known. The peculiarities in the armature, both of the sessile and tentacular-arms, as given above (p. 250) are quite sufficient, however, to warrant its separation from all the other genera. Its pen, as figured, also differs from all others, hitherto described. It is narrowest anteriorly, gradually and slightly expanding backward to the one-sided conical

hood or cone, which appears to be inserted into a solid terminal cone, much as in *L. robusta,* but the cone is relatively shorter. The caudal fin is large, rhomboidal, and acute posteriorly, as in the latter. The tentacular-club bears two large, abruptly curved, claw-like hooks in the middle, with numerous small suckers around them, and on the proximal part. The length of the head and body of the original example was about 28^{cm} (11 inches).

Mr. Dall has described a small species (probably young) from the coast of California, which may possibly belong to the same group. He referred it doubtfully to *Onychoteuthis* (*O. lobipennis* Dall).

Professor G. O. Sars, in his recent work (Mollusca Reg. Arct. Norvegiæ, p. 377), also mentions a specimen of *Architeuthis* (12 feet long), cast ashore on the Norwegian coast, at Foldenfjord, in 1874. He refers it doubtfully to "*A. dux* Steenstrup," (from the Kattegat) by which we should understand *A. monachus*, without doubt.

Note on Large Species of Octopus.

Although this article relates specially to the gigantic species of ten-armed Cephalopods, it may not be amiss to add a few lines in respect to species of *Octopus*, that attain large dimensions. It is certain, however, that none of the latter that have hitherto been examined by naturalists reach dimensions to be compared with those of the species of *Architeuthis*, *Onychoteuthis* (or *Lestoteuthis*) *robusta* and their allies.

The common *Octopus* of the west coast of North America (*O. punctatus* Gabb) is one of the largest of its tribe, hitherto studied. According to Mr. W. H. Dall,* it occurs abundantly at Sitka, and there "reaches a length of sixteen feet or a radial spread of nearly twenty-eight feet, but the whole mass is much smaller than that of the decapodous cephalopods of lesser length. In the Octopus above mentioned, the body would not exceed six inches in diameter and a foot in length, and the arms attain an extreme tenuity toward their tips." Dr. W. O. Ayres tells me that he has often seen this species exposed for sale in the markets of San Francisco (where it is eaten chiefly by the French), and that specimens with the arms 6 or 7 feet long are common. A smaller specimen, presented to the museum of Yale College, was over 4 feet long, and weighed 14½ pounds.

Prof. W. H. Brewer states that he has seen specimens in the San Francisco markets which spread fourteen feet across the outstretched arms.

* American Naturalist, vii, p. 485, 1873.

The common *Octopus vulgaris* ("poulpe" or "devil-fish") of the Mediterranean, sometimes grows to a somewhat formidable size. According to Verany, the largest one seen by him was 9 feet long and weighed 25 kilogrammes (Tryon). This one was captured by a fisherman, with his hands only.

A large species, perhaps the same, occurs in the West Indies. According to Professor B. G. Wilder,* a correspondent, Mr. J. S. George, of Nassau, N. P., mentions, in a letter, the occurrence there of an *Octopus* "ten feet long, each arm measuring five feet; the weight was estimated at between two hundred and three hundred pounds." It was found dead on the beach.

Specimens of similar size have been recorded from other parts of the world, while more or less fabulous accounts of more gigantic forms are numerous, especially among the early writers. But at present it seems most probable that the large fragments recorded as being frequently vomited by wounded sperm whales, belong to species allied to *Architeuthis*, though such fragments have often been referred to *Octopus*.

There is no satisfactory evidence that any of these species of *Octopus* ever intentionally attack man, or that any one has ever been seriously injured by them. They are rather sluggish and timid creatures, seeking shelter in holes and crevices among rocks. They feed mainly upon bivalve mollusks, but will also eat fish, and might, perhaps, like lobsters and crabs, devour dead bodies. Their power and ferocity, as well as their size, have often been excessively exaggerated.

ERRATA.

Page 190, line 32, for 2·5, read 3·5.
Page 193, line 11, for 1878, read 1879.

* American Naturalist, vol. vi, p. 772, 1872.